PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference NKT/0974-03	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/SG2003/000259	International Filing Date *(day/month/year)* 7 November 2003	Priority Date *(day/month/year)* 7 November 2003
International Patent Classification (IPC) or national classification and IPC Int. Cl. *A61C 7/28* (2006.01)		
Applicant INNOBRACE ORTHODONTICS PTE. LTD. et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   [X] This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 14 sheet(s).

3. This report contains indications relating to the following items:

   - I [X] Basis of the report
   - II [ ] Priority
   - III [ ] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV [ ] Lack of unity of invention
   - V [X] Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI [ ] Certain documents cited
   - VII [ ] Certain defects in the international application
   - VIII [ ] Certain observations on the international application

Date of submission of the demand 1 June 2005	Date of completion of the report 24 January 2006
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer KAREN VIOLANTE Telephone No. (02) 6283 7933

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SG2003/000259

I. Basis of the report

1. With regard to the elements of the international application:*

- [ ] the international application as originally filed.
- [X] the description, pages 1-4, as originally filed,
  pages , filed with the demand,
  pages 5-11, received on 19 January 2006 with the letter of 18 January 2006
- [X] the claims, pages , as originally filed,
  pages , as amended (together with any statement) under Article 19,
  pages , filed with the demand,
  pages 12-14, received on 19 January 2006 with the letter of 18 January 2006
- [X] the drawings, pages , as originally filed,
  pages , filed with the demand,
  pages 1/4-4/4, received on 19 January 2006 with the letter of 18 January 2006
- [ ] the sequence listing part of the description:
  pages , as originally filed
  pages , filed with the demand
  pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

- [ ] the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- [ ] the language of publication of the international application (under Rule 48.3(b)).
- [ ] the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- [ ] contained in the international application in written form.
- [ ] filed together with the international application in computer readable form.
- [ ] furnished subsequently to this Authority in written form.
- [ ] furnished subsequently to this Authority in computer readable form.
- [ ] The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- [ ] The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. [ ] The amendments have resulted in the cancellation of:
   - [ ] the description, pages
   - [ ] the claims, Nos.
   - [ ] the drawings, sheets/fig.

5. [ ] This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SG2003/000259

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-13	YES
	Claims	NO
Inventive step (IS)	Claims 1-13	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-13	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Novelty (N) Claims 1-13

Claims 1-13 meet the criteria set forth in PCT Article 33(2) for novelty. The prior art published before the priority date does not disclose an orthodontic appliance comprising a base portion, a body portion extending from the base portion and having an archwire receiving means and a first narrowing forming a neck portion with said base portion and provided substantially rear of the archwire receiving means.

The closest art of:

US 5174754

discloses an orthodontic appliance comprising a base portion, a body portion extending from the base portion and having an archwire receiving means and a first narrowing forming a cantilever notch provided on both sides of the archwire slot, but fails to disclose the notch may be provided substantially rear of the archwire receiving means.

Inventive Step (IS) Claims 1-13

Claims 1-13 meet the criteria set out in PCT Article 33(3) with regard to the requirement of Inventive Step because the prior art does not obviously suggest to a person skilled in the art of providing the first narrowing substantially rear of the archwire receiving means.

Industrial Applicability (IA) Claims 1-13

The invention defined in the claims is considered to meet the requirements of Industrial Applicability under Article 33(4) of the PCT because it can be made by, or used in, industry.

base or the common general knowledge in the relevant art in Singapore or elsewhere on or before the priority date of the disclosure and claims herein.

An object of the present invention is to provide an improved orthodontic appliance.

A further object of the present invention is to alleviate at least one disadvantage associated with the prior art.

SUMMARY OF THE INVENTION

The present invention provides, in one aspect, an orthodontic appliance comprising a base portion adapted for bonding to a surface of a tooth, a body portion extending from the base portion and having an archwire receiving means and a first narrowing forming a neck portion with the base portion and provided substantially rear of the archwire receiving means. The archwire receiving means has a slot substantially adapted to receive a portion of the archwire and having an opening comprising a narrowing portion which is narrower than the slot.

In a preferred embodiment, the second narrowing portion is provided along a length and / or opening of the archwire receiving means. Preferably, the second narrowing is provided at at least one point along a length and / or opening of the archwire receiving means. The second narrowing portion may preferably be at least one protrusion or rib.

The present invention also provides, in another aspect, a kinematic inversion of the aspect above, in which the orthodontic appliance comprises a base portion adapted for bonding to a surface of a tooth, a body portion extending from the base portion and having an archwire receiving means and a first narrowing forming a neck portion with the base portion and provided substantially rear of the archwire receiving means, the archwire receiving means having a slot substantially adapted to receive a portion of the archwire and having an opening comprising an enlarged portion which is broader than the slot. Preferably, the enlarged portion is provided along a length and / or opening of the archwire receiving means, or provided as one or more points

along a length and / or breadth of the archwire receiving means. The enlarged portion may be provided as a protrusion or rib.

In another aspect of the invention, a method is provided for straightening teeth with an orthodontic appliance as aforedescribed, including an orthodontic bracket, comprising the steps of bonding a base portion of the appliance to a surface of a tooth, coupling an archwire to said orthodontic appliance, including placing the archwire proximate an archwire receiving means, and moving the archwire into contact with either a narrowing portion of the archwire receiving means or an enlarged portion of the receiving means; and pushing said archwire substantially past said narrowing portion or enlarged portion.

Other aspects and preferred aspects are disclosed in the specification and / or defined in the appended claims, forming a part of the description of the invention.

In essence, the present invention stems from the desire to provide an orthodontic appliance with a design which is able to accept an orthodontic archwire in which insertion and removal do not require a separate step of ligation. In this regard, the present invention is directed towards an orthodontic appliance, such as a bracket or buccal tube, having features that represent significant advantages over currently available self-ligating or self-releasing appliances. The body portion and the archwire receiving means of the present appliance is constructed in one piece, has a first narrowing connecting the base to the archwire receiving means being provided substantially rear of the archwire receiving means, is simple to make and even simpler to use as compared to all existing orthodontic appliances. Essentially a no ligation system is used that obviates the need for a separate step (usually also with separate instruments) to insert and remove archwires from archwire slots of orthodontic appliances. The present invention unlike all self-ligating or self-releasing systems does not require tiny movable parts as tiny movable parts may fall with prolonged usage in the oral cavity.

In the present invention, the 'narrowing' being an opening in the archwire receiving means referred to may be rendered a number of ways or in

combination with a lobe, projection, knob, ledge, ridge, boss, extension, flange, hump, lump, lip, nib, protrusion, ramp, rib, skirt, tongue, wedge or the like.

In the present invention, the 'narrowing' connection being a portion connecting the base to the archwire receiving means may be rendered in any suitable manner so as to provide some flex in the operation of the archwire receiving means.

The present invention should not be limited to only the embodiment disclosed. For example, as is contemplated in the present invention, the 'narrowing' opening may be formed in the archwire, and / or be a kinematic inversion of the embodiment disclosed herein for illustrative purposes only. Likewise, the 'narrowing' connection may be formed by a combination of features of the appliance and the archwire receiving means.

The present invention has been found to result in a number of advantages, such as:

- no tiny movable parts,
- ease of insertion and removal of archwire without the need of additional instruments to move the movable part of the bracket from open to close position and vice versa and
- simple to make as the body portion and the archwire receiving means of the orthodontic appliance is constructed in one piece.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

Further disclosure, objects, advantages and aspects of the present application may be better understood by those skilled in the relevant art by

reference to the following description of preferred embodiments taken in conjunction with the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and in which:

Figure 1 illustrates a side elevation view of an orthodontic appliance of the present invention,

Figure 2 illustrates a front elevation view of the orthodontic appliance of Figure 1,

Figure 3 illustrates a side elevation view of another embodiment of an orthodontic appliance,

Figure 4 illustrates a front elevation view of the orthodontic appliance of Figure 3,

Figure 5 illustrates a side elevation view of the orthodontic appliance, in use, and

Figure 6 illustrates a side elevation view of the orthodontic appliance, in use when a large torque force is applied.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figures 1 and 2, the side and front elevation view of one embodiment of the present invention are shown. It can be seen that the present invention provides an orthodontic appliance, such as a bracket 1 which has an integrally formed narrowing opening 2 proximate archwire slot 3 as well as a narrowing connection 5. The narrowing 5 is provided substantially rear of the archwire receiving means. The narrowing 2 may be provided as strip substantially proximate the length of the slot 3, and / or may be provided only at one or more points proximate the slot 3. The narrowing 2 may also be providing a one or more points or sections along the depth of the slot.3.

In accordance with the present invention, the extent of narrowings 2 and 5 may be used to determine the force(s) needed to install in, remove from and / or adjust an archwire in the appliance slot.

The present invention also provides, in another aspect, a kinematic inversion of the aspect above, in which the orthodontic appliance has an integrally formed enlarged portion proximate archwire slot. The enlarged portion may be provided as strip substantially proximate the length of the slot, and / or may be provided only at one or more points proximate the slot. The enlarged portion may also be providing a one or more points or sections along the depth of the slot.

Referring to Figures 3 and 4, the side and front elevation view of another embodiment of the present invention are shown. Because there are no elastomeric or metal ligatures required for the present appliance, in use, no tie wings are required and the design of the appliance can be simplified and made smaller for maximum patient comfort. In this present invention, orthodontic appliances can be smaller, more aesthetic and more comfortable with absolutely no sharp edges, as shown in Figures 3 and 4. When in use, the present orthodontic appliances are further away from occlusal or biting forces from opposing jaw, as the present orthodontic appliances are vertically smaller compared with other conventional orthodontic brackets.

It can be seen, advantageously that the present invention has substantially no moving parts, and thus avoids many of the disadvantages associated with the prior art.

In the system of the present invention, the force to insert or remove the archwire is designed to be below the force that bonds the bracket to the tooth which is usually in excess of 50N. It is however above the force that is normally required to effect tooth movements such as tipping, intrusion, extrusion, rotation and bodily movements. Normal orthodontic forces are usually below 200gf per tooth. The preferred force to insert or remove the archwire is below 2.5kgf. The force to remove the archwire from the archwire slot is preferably less than half of that required to pull the bracket away from the tooth and therefore the integrity of the bracket with respect to the tooth it is bonded to will not be compromised.

The force required to insert the archwire is ideally above that to effect tooth movement and is approximately between 1 to 2.5 kgf.

Referring to Figure 5, after an appliance according to the present invention is bonded to the tooth, the orthodontist proceeds to select an appropriate archwire 4 and pushes the archwire 4 through the narrowing opening 2 of the present invention and into the archwire slot 3 digitally with a force of approximately 1 to 2.5kgf. Preferably, the narrowing 2 is formed proximate the gingival and occlusal sides of the archwire slot and in installing the archwire, the narrowing connection 5 enables the narrowing opening 2 to become more distal with respect to each other on application of force at the entrance of the archwire slot in the direction towards the bracket. This is indicated by arrows 6. When the archwire is fully inside the slot, the force to open the bracket is removed and the gingival and occlusal sides of the archwire slot will revert to the previously passive state, and in one form, parallel to each other.

To remove the archwire again a force of about 1 to 2.5kgf is applied digitally through the archwire and away from the archwire slot. Again the narrowing of the present invention preferably proximate normally parallel gingival and occlusal sides of the archwire slot will become more distal to allow the exit of the said archwire.

The procedure for insertion and removal of archwire can be easily done by the orthodontist without the need for additional opening and closing instruments.

There are no tiny movable latches in the present invention, therefore the structural integrity of the appliance of the present invention is maintained.

Referring to Figure 6, when a large torque force is needed to speedily correct, for example, severely malpositioned teeth, the substantially elastic nature of the narrowing of the present invention, for example proximate the gingival/occlusal sides of the archwire slots ensure that such forces are partially cushioned by the bracket system thereby moderating the high force levels. This has been found to reduce patient's pain and discomfort while ensuring a near constant and optimum force level for tooth movement.

The material that can be used to construct the present appliance may be a metal or alloy with a high modulus of elasticity, a plastic or a polymer or a ceramic material.

While this invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further modification(s). This application is intended to cover any variations, uses or adaptations of the invention following in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice within the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth.

As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit the present invention unless otherwise specified, but rather should be construed broadly within the spirit and scope of the invention as defined in the appended claims. Various modifications and equivalent arrangements are intended to be included within the spirit and scope of the invention and appended claims. Therefore, the specific embodiments are to be understood to be illustrative of the many ways in which the principles of the present invention may be practiced. In the following claims, means-plus-function clauses are intended to cover structures as performing the defined function and not only structural equivalents, but also equivalent structures. For example, although a nail and a screw may not be structural equivalents in that a nail employs a cylindrical surface to secure wooden parts together, whereas a screw employs a helical surface to secure wooden parts together, in the environment of fastening wooden parts, a nail and a screw are equivalent structures.

"Comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof."

CLAIMS

1. An orthodontic appliance comprising:

a base portion (8) adapted for bonding to a surface of a tooth,

a body portion extending from the base portion (8) and having an archwire receiving means and a first narrowing (5) forming a neck portion with said base portion (8) and provided substantially rear of the archwire receiving means,

the archwire receiving means having a slot (3) substantially adapted to receive a portion of an archwire (4) and having an opening (9) comprising a second narrowing portion which is narrower than the slot (3).

2. An orthodontic appliance as claimed in claim 1, wherein the second narrowing portion is provided along a length and / or opening of the archwire receiving means.

3. An orthodontic appliance as claimed in claim 1 or 2, wherein the second narrowing is provided at at least one point along a length and / or opening of the archwire receiving means.

4. An orthodontic appliance as claimed in any one of the preceding claims wherein the second narrowing portion is at least one protrusion or rib (2).

5. An orthodontic appliance comprising:

a base portion (8) adapted for bonding to a surface of a tooth,

a body portion extending from the base portion (8) and having an archwire receiving means and a first narrowing (5) forming a neck portion with said base portion (8) and provided substantially rear of the archwire receiving means,

the archwire receiving means having a slot (3) substantially adapted to receive a portion of an archwire (4) and having an opening (9) comprising an enlarged portion which is broader than the slot (3).

6. An orthodontic appliance as claimed in claim 5, wherein the enlarged portion is provided along a length and / or opening (9) of the archwire receiving means.

7. An orthodontic appliance as claimed in claim 5 or 6, wherein the enlarged portion is provided as one or more points along a length and / or breadth of the archwire receiving means.

8. An orthodontic appliance as claimed in any one of claims 5 to 7, wherein the enlarged portion is at least one protrusion or rib (2).

9. An orthodontic appliance as claimed in any one of the preceding claims, wherein the appliance is an orthodontic bracket.

10. A method for straightening teeth with an orthodontic appliance according to any one of claims 1 to 9, comprising the steps of:

- bonding a base portion of the appliance to a surface of a tooth;
- coupling an archwire to said orthodontic appliance, including
  - placing the archwire proximate an archwire receiving means, and
  - moving the archwire into contact with either a narrowing portion of the archwire receiving means or an enlarged portion of the receiving means; and
  - pushing said archwire substantially past said narrowing portion or enlarged portion.

11. A method as claimed in claim 10, wherein the orthodontic appliance is an appliance as claimed in any one of claims 1 to 9.

12. An appliance substantially as herein disclosed.

13. A method substantially as herein disclosed.

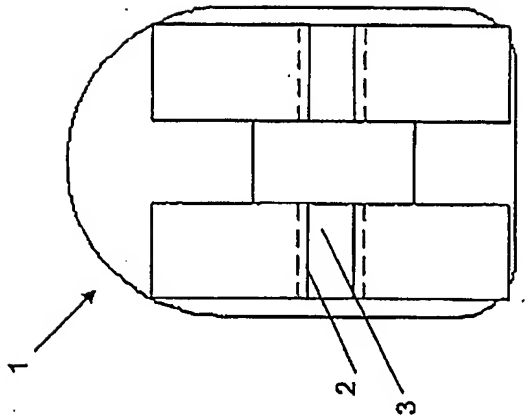


Figure 2

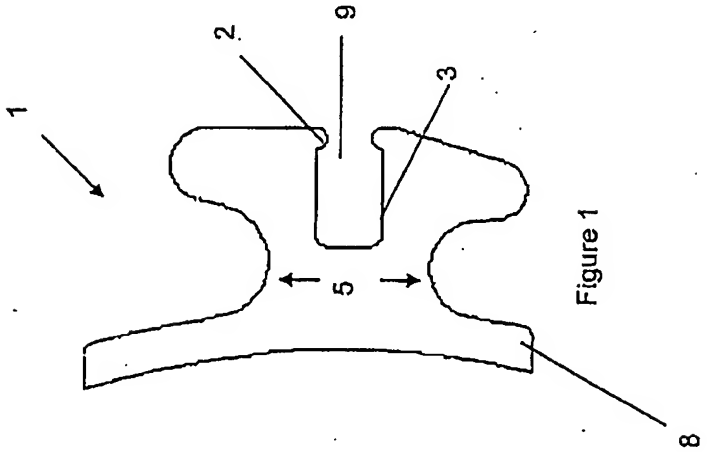


Figure 1

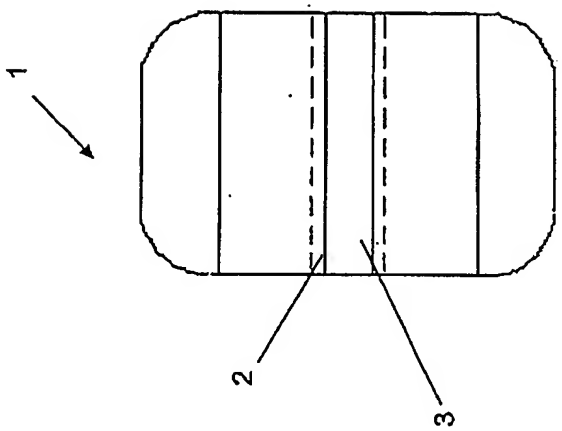


Figure 4

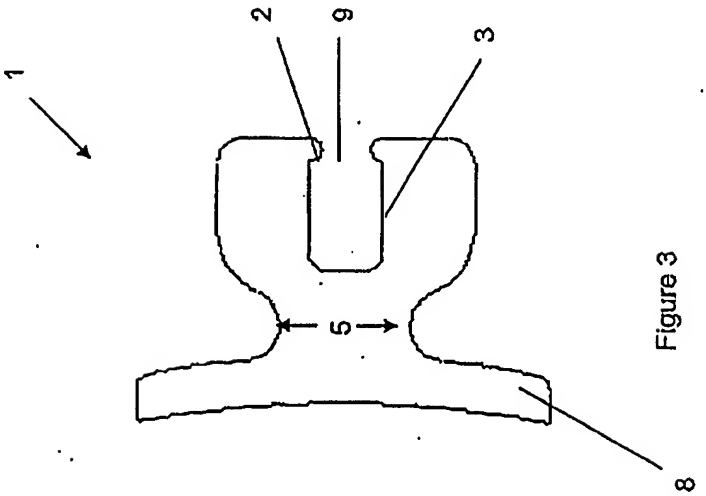


Figure 3

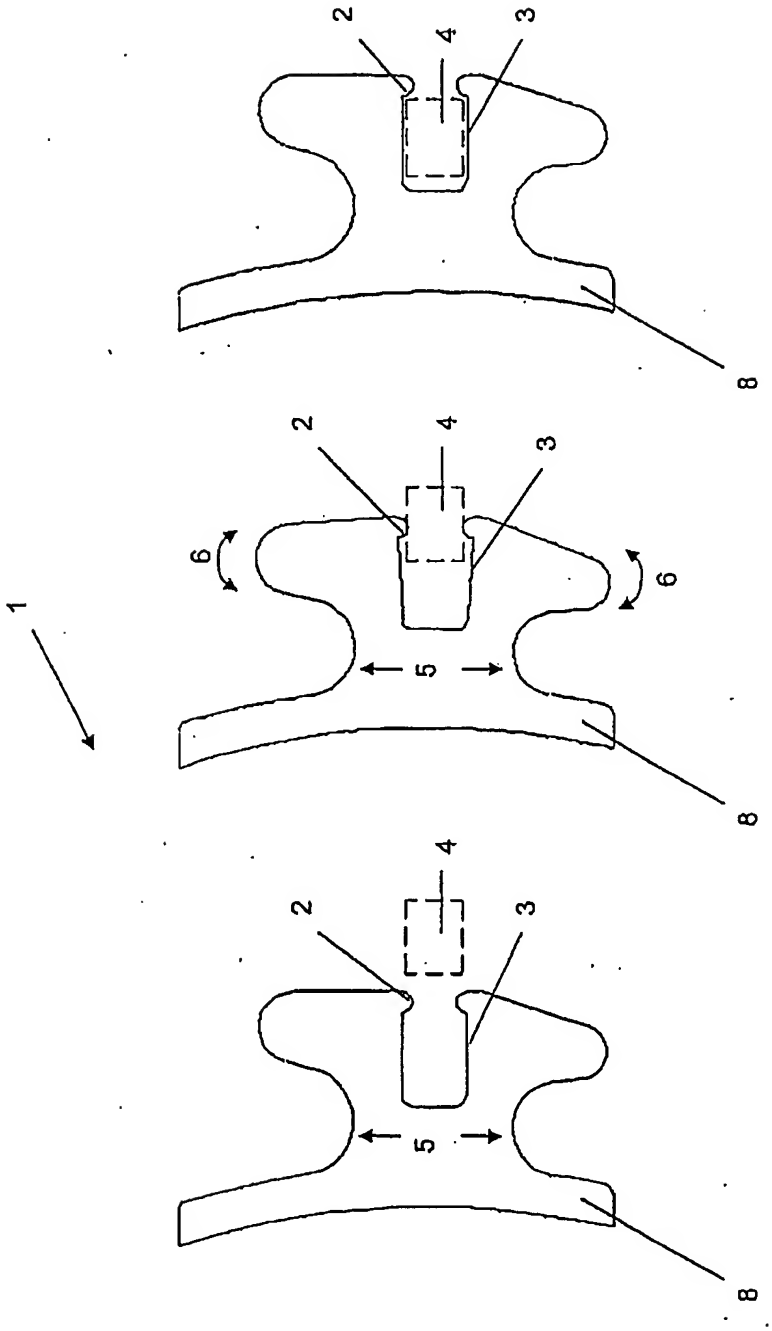
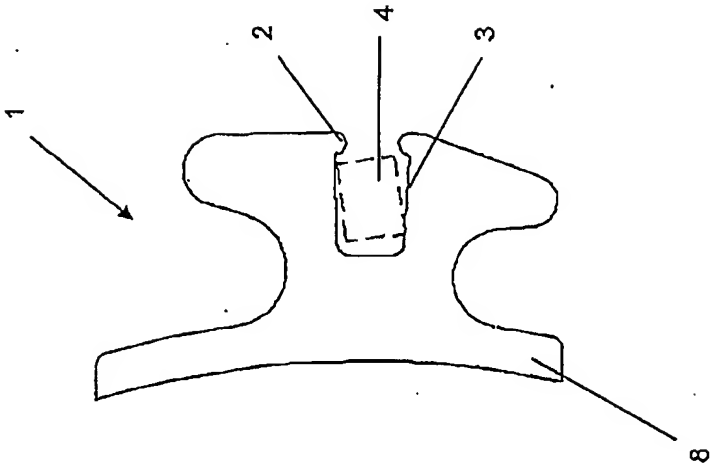


Figure 5



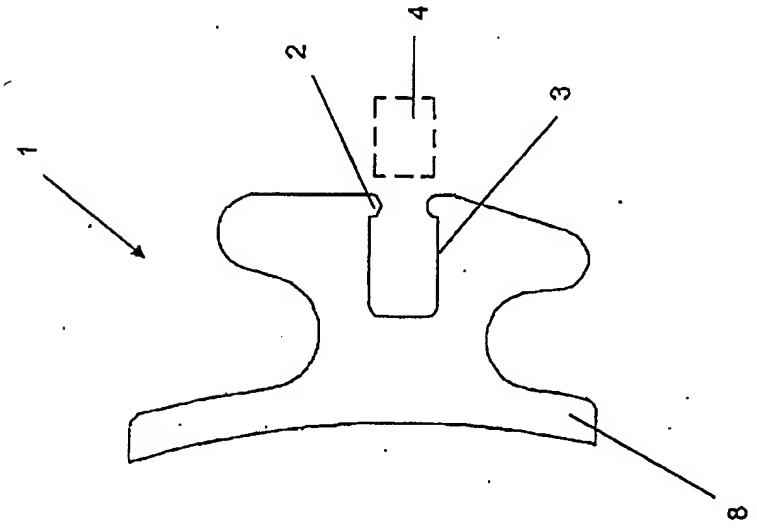


Figure 6